T/N 253
Filing Code 6763

Date Issued November 1974

TECHNICAL NOTE

U.S. DEPARTMENT OF THE INTERIOR – BUREAU OF LAND MANAGEMENT

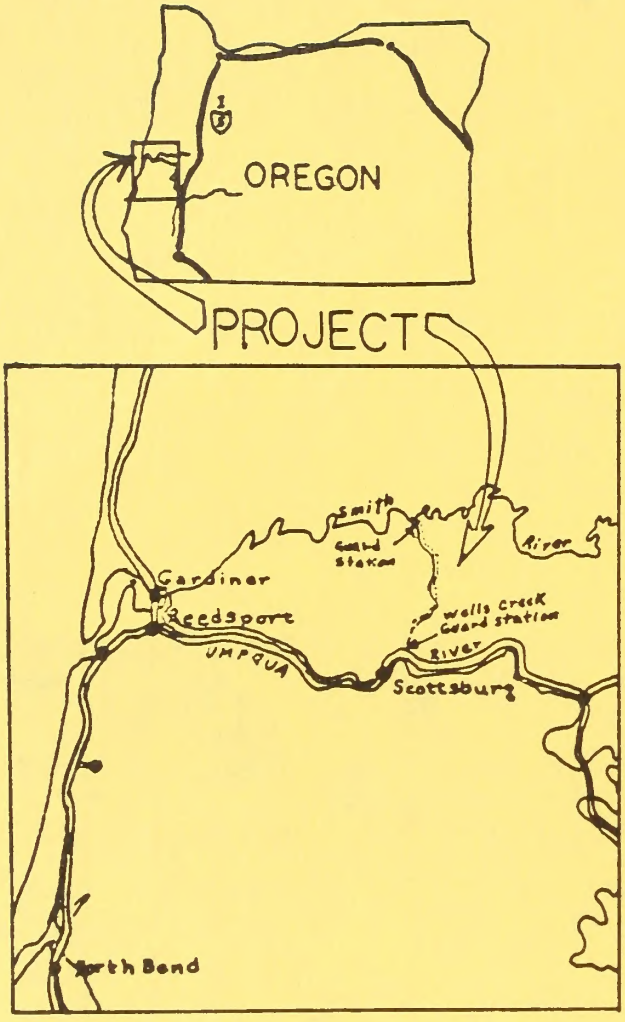
VINCENT CREEK FISH PASS

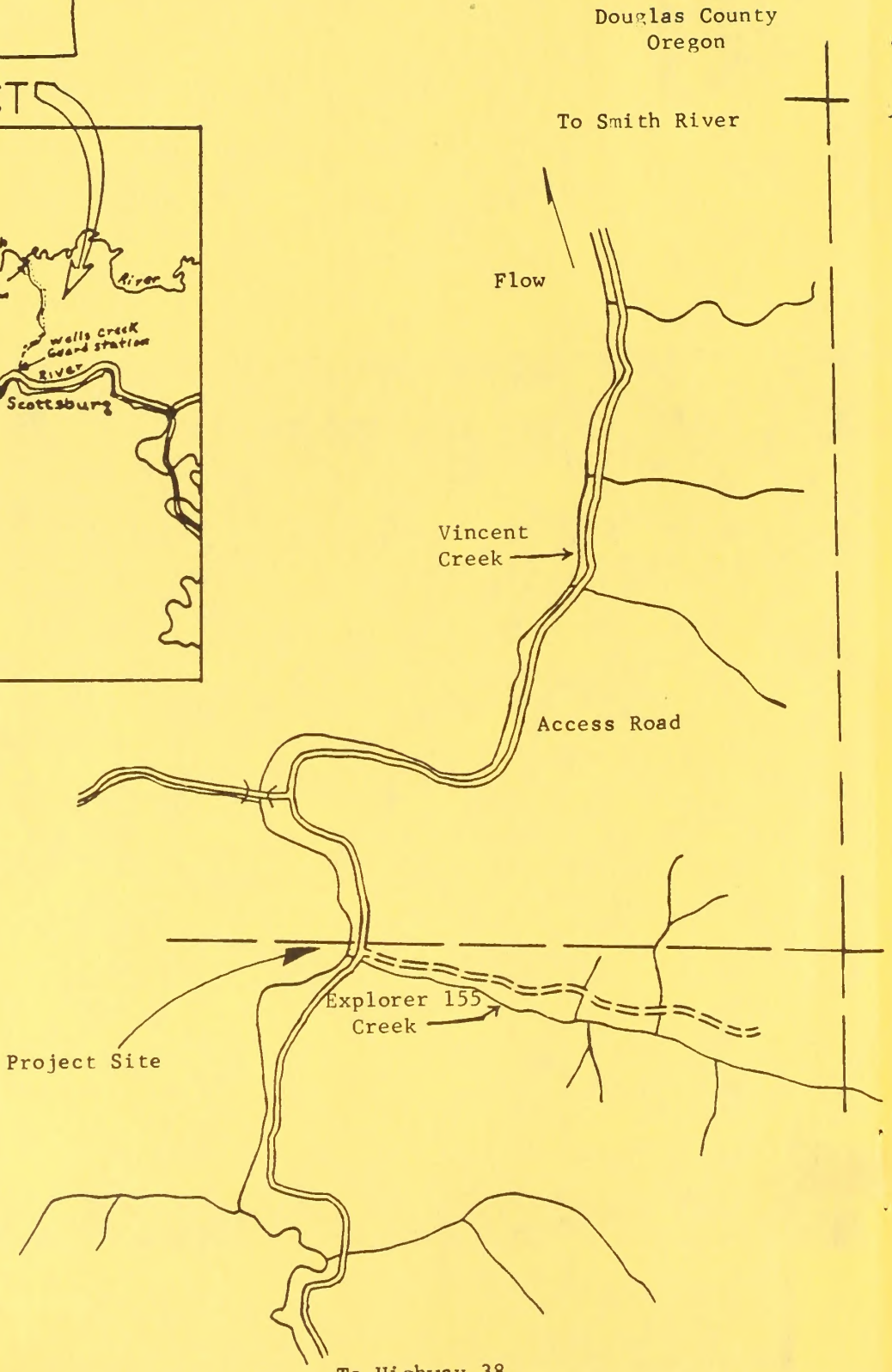
John W. Anderson, Fishery Biologist
Coos Bay District, Oregon

Additional copies of Technical Notes are available from DSC, Federal Center Building 50, Denver, Colo., 80225

LOCATION MAP

Scale: 1" equals 1000'





I. INTRODUCTION

In past years timber access road construction often failed to adequately provide for or consider the needs of anadromous fish (BLM Manual 5110). Many metal culverts placed in streams used by anadromous fish have blocked fish passage when installed with the lower end too high above the stream (BLM Manual 6760). The size of culvert, bottom type and stream banks all influence the type of facility that can be installed to provide fish passage when an impassable culvert is located. One solution to a specific problem is discussed here. This solution cannot be applied randomly but it does provide an idea upon which engineers can build designs and make appropriate modifications.

II. BACKGROUND

A culvert installation on Explorer 155 Creek, a tributary of Vincent Creek in the Smith River basin, was identified as a total barrier to fish passage. The culvert was placed on top of a 7.5' high fill that was pushed into the stream at its confluence with Vincent Creek in 1958. The 5' diameter culvert was then covered with 24' of fill to establish an even road grade (Illustrations 1 and 5). The road is a mainline, hard surface road paralleling Vincent Creek. It was estimated that it would cost $35,000 to remove the culvert and fill and replace it with a bridge. The gradient may have been too steep to provide fish passage even after such a major project was undertaken.

It was suggested by the District Fishery Biologist that a ladder box and modified Alaskan steeppass fish ladder be installed to bring fish up to the culvert mouth (Illustration 6). The culvert was nearly level which made it passable if fish could reach it.

III. DESCRIPTION

A 30-foot length of Modified Alaskan Steeppass constructed of 3/16-inch thick ASTMA-A36 copper steel plate was fabricated and galvanized (Illustration 2). All portions of the unit were welded together with no bolts or rivets used in the 30-foot unit (Illustration 2). The bid price of $2962 included delivery of the unit to the site.

A site survey of the area at the confluence of Explorer 155 Creek and Vincent Creek was made to provide a detailed 2-foot contour topographic map (Illustration 3). This information was then used to design the ladder box and support piers. The concrete work was designed by BLM Civil Engineering staff to withstand intense water pressures generated during winter high flows (Illustration 4). The installation was completed during the summer of 1973. The cost of installation was $8135.50 in addition to the metal fishpass. A misinterpretation of the design during construction resulted in the ladder box being modified and the riprap being improperly placed. The result of these errors is discussed under Section IV of this note.

IV. EVALUATION

The success of the installation was apparent when adult coho salmon were observed by the District Fishery Biologist moving through it and spawning in Explorer 155 Creek during the fall of 1973. The stream had not produced salmon in the 15 years since the road was built. Coho were observed moving into the ladder box and maintaining their position with very little effort. A 16" searun cutthroat trout was observed above the installation which indicated that smaller fish also negotiated the facility. During the winter and spring months numerous steelhead were observed spawning in the creek. The steelhead apparently moved in and out of the creek with no difficulty.

During the spring a fry trap was operated to monitor the success of coho and steelhead spawning. Although high water made the trap inoperable about 50% of the time during coho outmigration, more than 800 coho fry were counted. Lower water conditions during the steelhead hatch provided an outmigrant steelhead count of approximately 1700 fry. In addition to the outmigrants, numerous juvenile coho and steelhead will remain in Explorer Creek for at least one year.

The major problem with the installation occurred when a large amount of water moved bedload material out of the culvert. Numerous waterlogged pieces of wood and limbs had collected over many years in the culvert which had been partially blocked at the mouth. These chunks clogged the baffle fins of the fishpass. This problem was compounded by two factors. The front of the ladder box was built 8" higher than originally planned which forced most extra flow into the ladder slot instead of allowing it to spill evenly across the box front (See Illustrations 7 and 8).

The riprap was placed in such a manner that excess water was channeled into the top of the open steeppass (Illustration 8). The extremely high flows then washed volleyball-sized riprap into the steeppass where they were held in place by the previously mentioned wooden chunks. (The original design for the riprap called for a contouring that would channel excess water away from the steeppass.)

The blockage of the steeppass was cleaned out in less than an hour by hand. Since the ladder was cleaned, only minor maintenance has been necessary. The facility remains completely clear most of the time and observation has indicated that fish were able to negotiate the steeppass when it was heavily clogged with debris. Clogging, although a problem initially, does not appear to be a major problem in that the area has stabilized following the initial flushing. Minor bedload material, such as sand, gravel and stones up to 6" in diameter roll through without stopping and have been no problem.

The ladder box was designed to be large enough to provide a holding area for fish before they entered the culvert. The depth of the box was 5-feet. The stream bedload has filled the box level with the bottom of the steeppass slot (Illustration 7). No pool area is apparent at low flow and only a shallow pool 30-inches deep is present at high flow. One spent coho male was observed maintaining his position for at least 30 minutes or more without apparent difficulty.

It would appear that the size of the box in length and width is quite adequate. The box has a depth of 2-feet 2½" below the steeppass bottom. The proper depth for the box to facilitate fish passage was unknown at the time of design, but some additional depth below the bottom of the steeppass exit was believed desirable. The filling of the box with bedload indicates that an extremely deep box would be of little value for similar installations which have considerable movement of bedload. However, the distribution of bedload flush with the bottom of the steeppass has formed a normal gravel stream channel which shifts about within the box. This channel may be beneficial in that is is irregular enough to slow velocities and somewhat more natural feeling to the fish than a smooth cement slab with a sheet of water pouring across it.

V. SUMMARY

Although the Explorer 155 Creek fish passage facility has been operational for less than one year, it has survived one of the area's largest floods and appears to be a successful solution to a fish passage problem because:

(1) It allows fish to migrate into and out of the culvert at flows commonly used by anadromous fish for migration.

(2) It requires a low maintenance effort. (Cleaning can be accomplished in 10 minutes or less.)

(3) It is structurally sound and has not caused any new problems in fisheries or other natural resources.

(4) It solved a fish migration problem at a much lower cost than required to rebuild the stream crossing.

(5) It provided one half mile of spawning and rearing area for anadromous fish.

REFERENCES

Bureau of Land Management. Manual 5110 - Stream Protection. 1969. 11 p.

Bureau of Land Management. Manual 6760 - Stream Preservation and Improvement. 1969. 49 p.

Oregon Revised Statutes. Stream Obstructions. 509.605.

Ziemer, G. L. Informational Leaflet No. 12 - Steeppass Fishway Development. Alaska Department of Fish and Game.

Ziemer, G. L. Addenda to Informational Leaflet No. 12 - Steeppass Fishway Development. Alaska Department of Fish and Game.

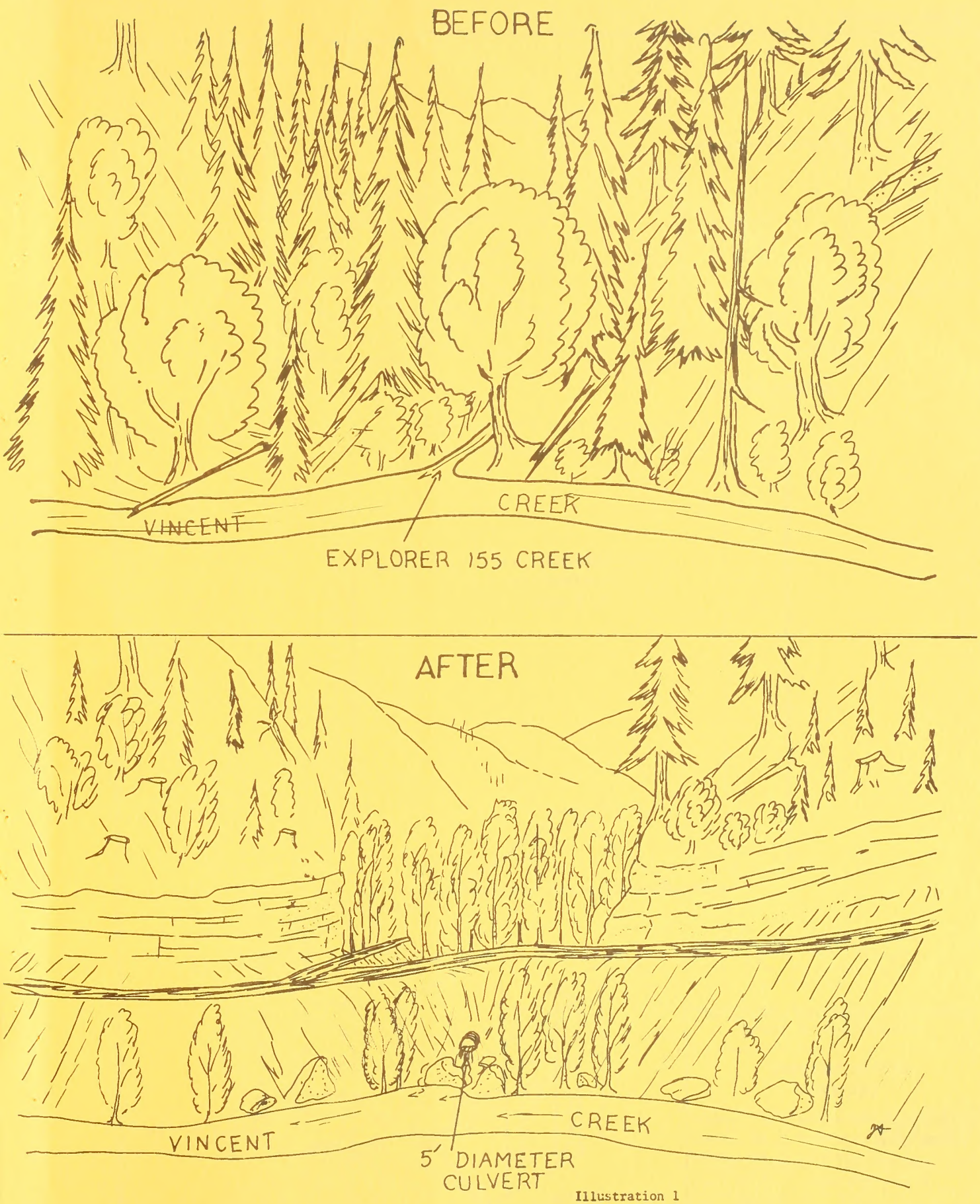
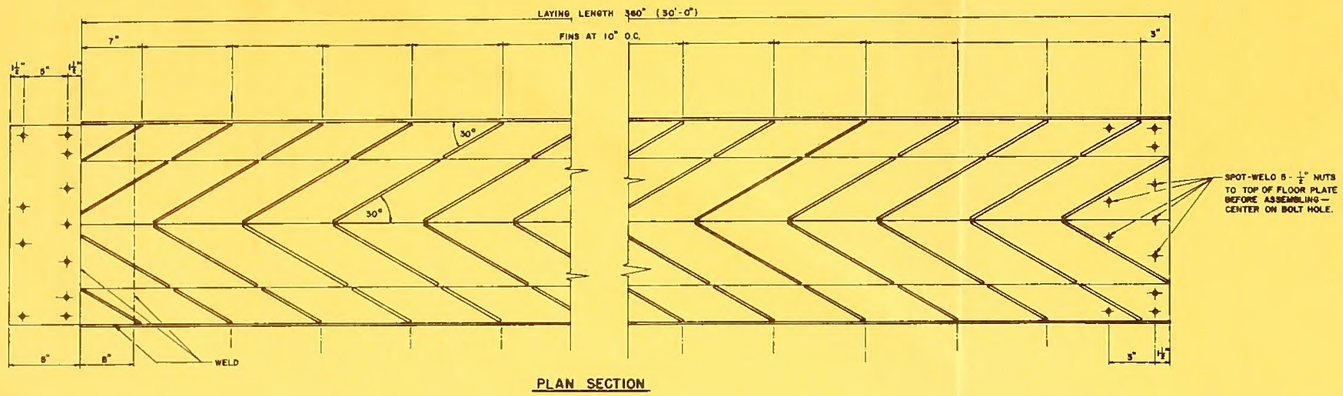


Illustration 1

Explorer 155 Creek before and after road construction



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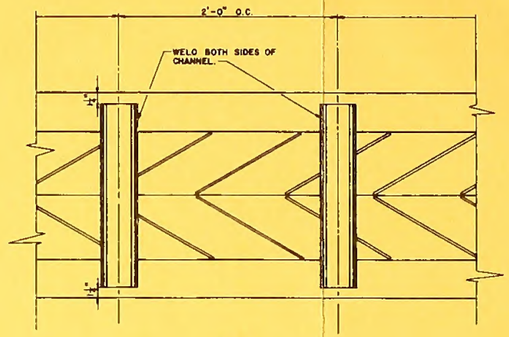
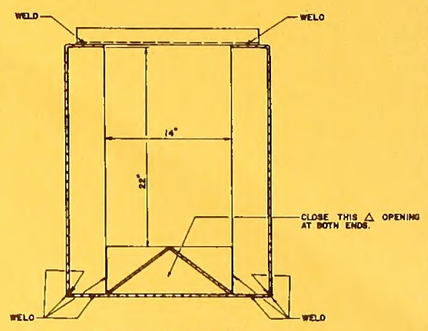


PLAN



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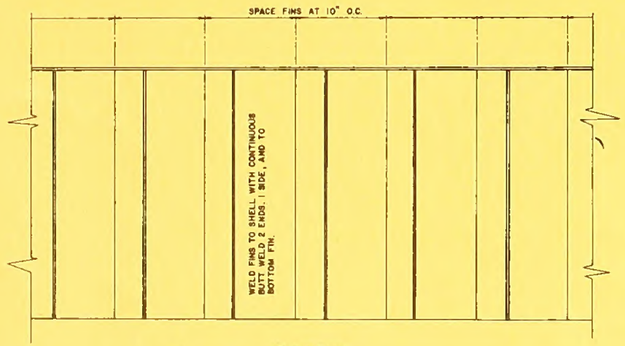

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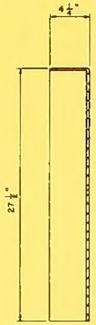
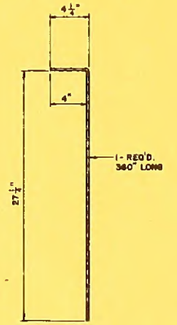


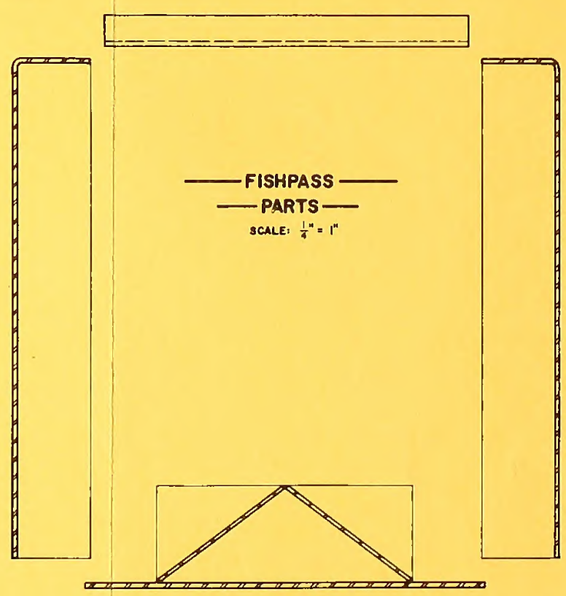
X-SECTION

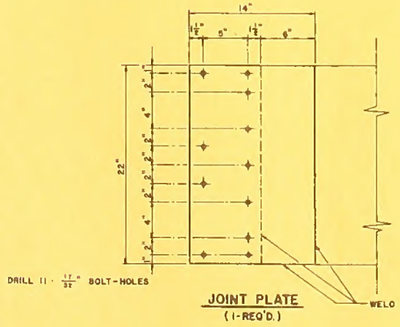
FIN



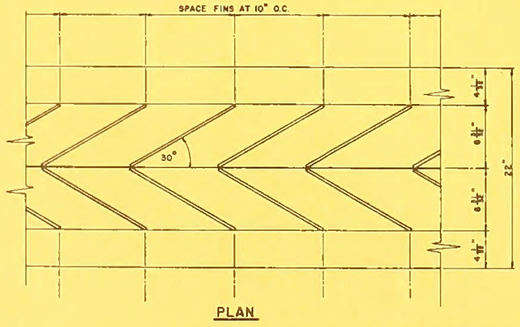
SHELL

SIDE PANEL — 2-REQUIRED



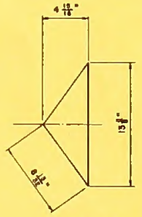


JOINT PLATE (1-REQ'D.)

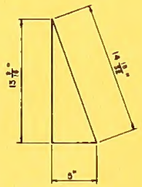


PLAN

X-SECTION



END SEAL

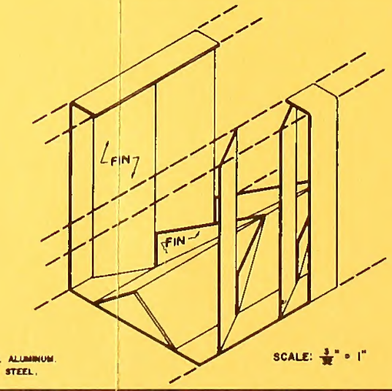


FIN

BOTTOM PANEL — 1-REQUIRED

TOP-TIES

NOTE: TOP TIES SHALL BE:
OPTION 1 - 4" 2.16 lb./ft. ALUMINUM
OPTION 2 - 4" 5.4 lb./ft. STEEL.



SCALE: ½" = 1"

NOTICE: THIS DRAWING HAS BEEN REDUCED FOR BIDDING PURPOSES. A FULL SIZE PRINT WILL BE PROVIDED TO THE SUCCESSFUL BIDDER.

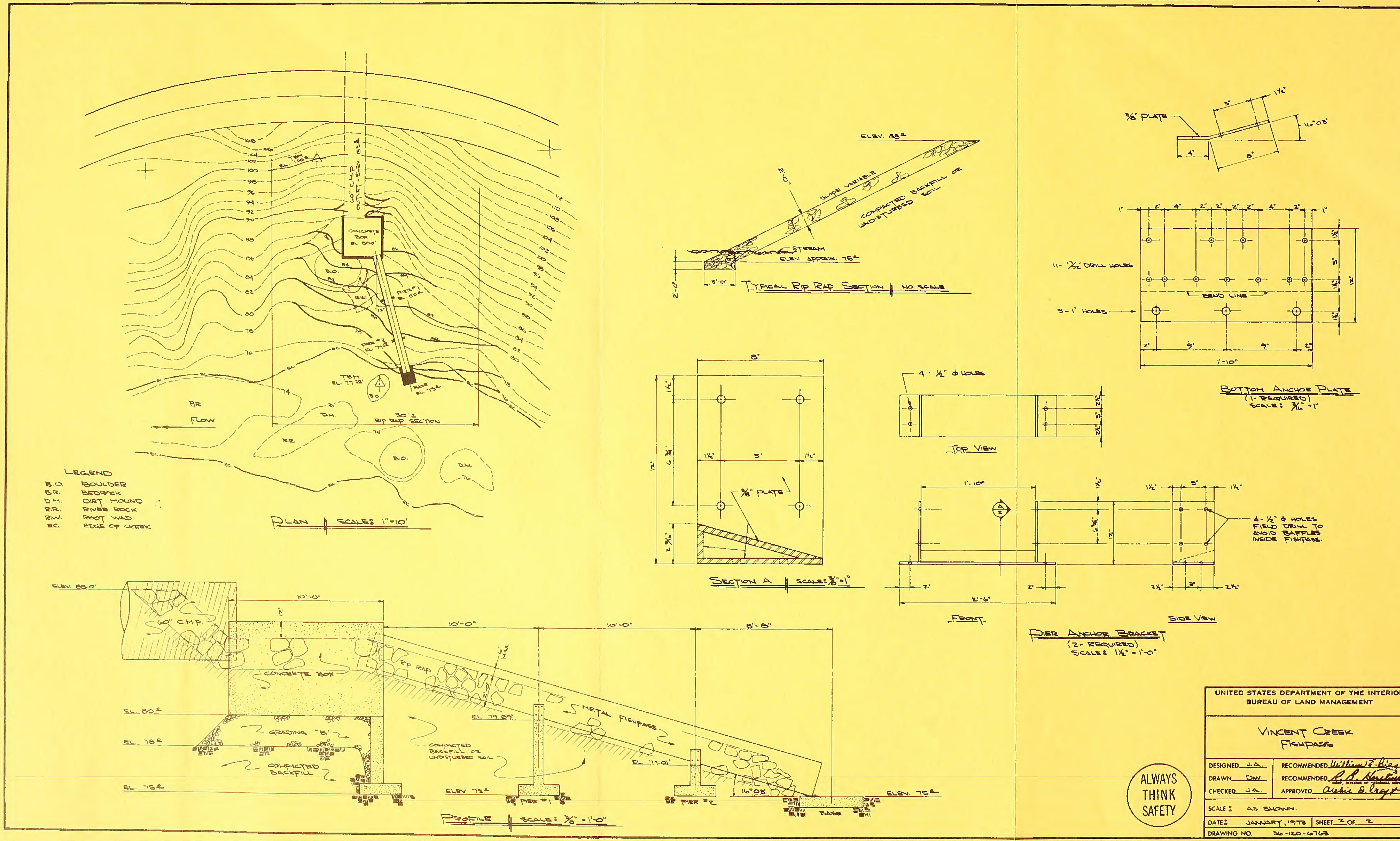
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VINCENT CREEK FISHPASS

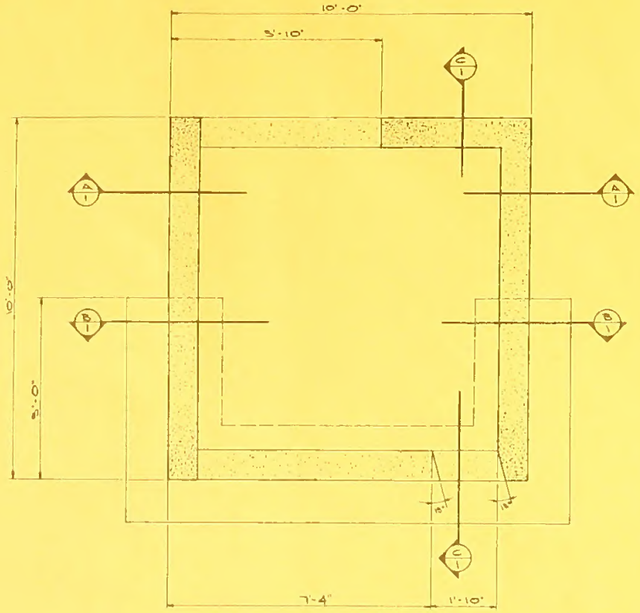
DESIGNED J.A.	RECOMMENDED William E. Curtis, CHIEF, ENGINEERING AND CONSTRUCTION SECTION
DRAWN D.W.	RECOMMENDED R.B. Hamilton, CHIEF, BRANCH OF FIELD SERVICES
CHECKED J.A.	APPROVED ____, STATE DIRECTOR
SCALE 1" = 1"	SCALE EXCEPT AS NOTED.
DATE NOV., 1971	SHEET ___ OF ___
DRAWING NO. 36-120-6762.6-2	

Illustration 3

Engineering design for ladder box and fishpass installation with 2' contour map



LEGEND
B.O. BOULDER
B.R. BEDROCK
D.M. DIRT MOUND
R.R. RIVER ROCK
R.W. ROOT WAD
E.C. EDGE OF CREEK
PLAN | SCALE: 1"=10'
FLOW
CONCRETE BOX EL. 80.0'
30' ± RIP RAP SECTION
TYPICAL RIP RAP SECTION | NO SCALE
ELEV. 88.2
SLOPE VARIABLE
COMPACTED BACKFILL OR UNDISTURBED SOIL
STREAM ELEV. APPROX. 75.2
SECTION A | SCALE: 3/4"=1"
3/8" PLATE
TOP VIEW
FRONT
SIDE VIEW
4 - 1/2" ϕ HOLES
4 - 1/2" ϕ HOLES FIELD DRILL TO AVOID BAFFLES INSIDE FISHPASS.
PIER ANCHOR BRACKET (2 - REQUIRED) SCALE: 1 1/2" = 1'-0"
BOTTOM ANCHOR PLATE (1 - REQUIRED) SCALE: 3/16" = 1"
11 - 17/32" DRILL HOLES
3 - 1" HOLES
BEND LINE
PROFILE | SCALE: 3/8" = 1'-0"
60" C.M.P.
CONCRETE BOX
RIP RAP
METAL FISHPASS
GRADING "B"
COMPACTED BACKFILL
COMPACTED BACKFILL OR UNDISTURBED SOIL
PIER #1
PIER #2
BASE
ELEV. 88.0'
EL. 80.2
EL. 78.2
EL. 75.2
ELEV. 75.2
EL. 79.89'
EL. 77.01'
16°08'
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
VINCENT CREEK FISHPASS
DESIGNED J.A.
DRAWN DW
CHECKED J.A.
SCALE: AS SHOWN
DATE: JANUARY, 1978
SHEET 2 OF 2
DRAWING NO. 36-120-6763
ALWAYS THINK SAFETY



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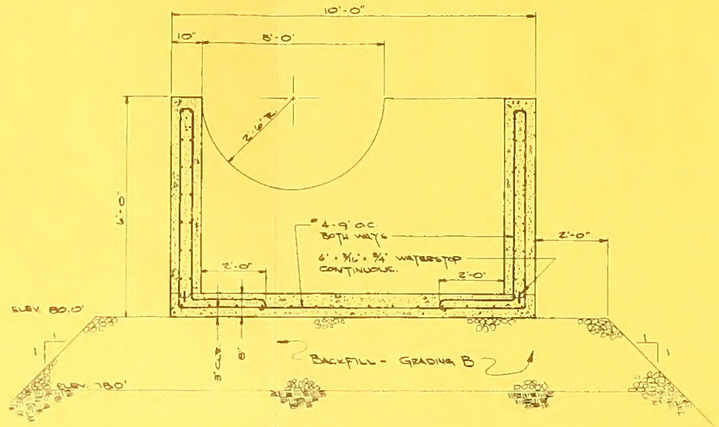
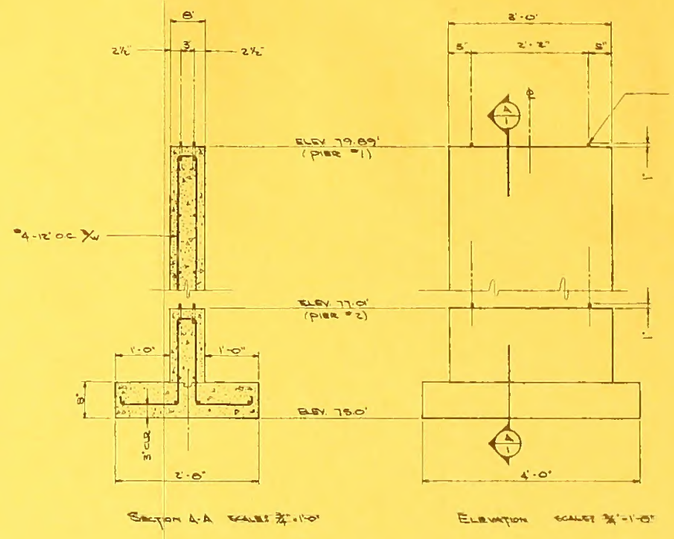
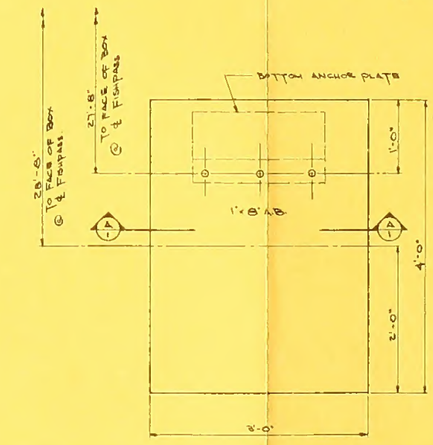


SECTION A-A SCALE: ½"=1'-0"

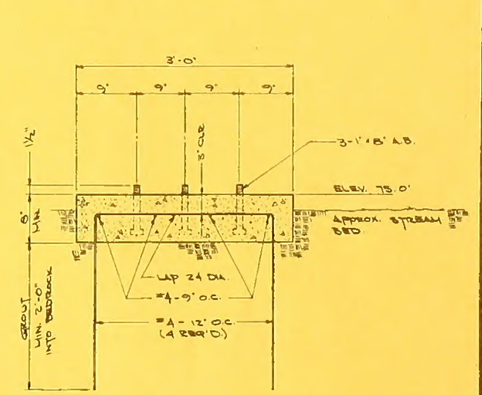


SECTION A-A SCALE: ¾"=1'-0" ELEVATION SCALE: ¾"=1'-0"

PIER

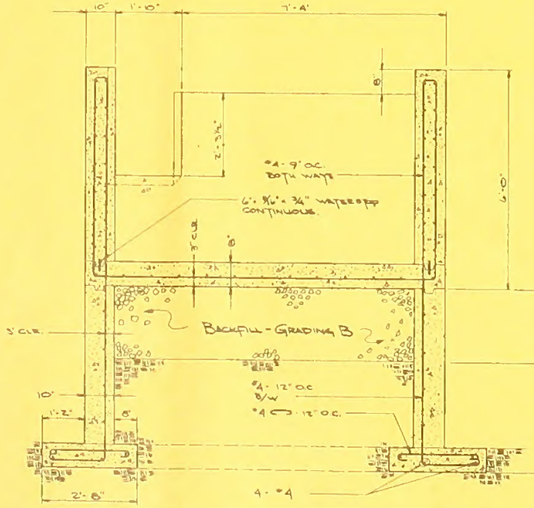


PLAN SCALE: 1"=1'-0"

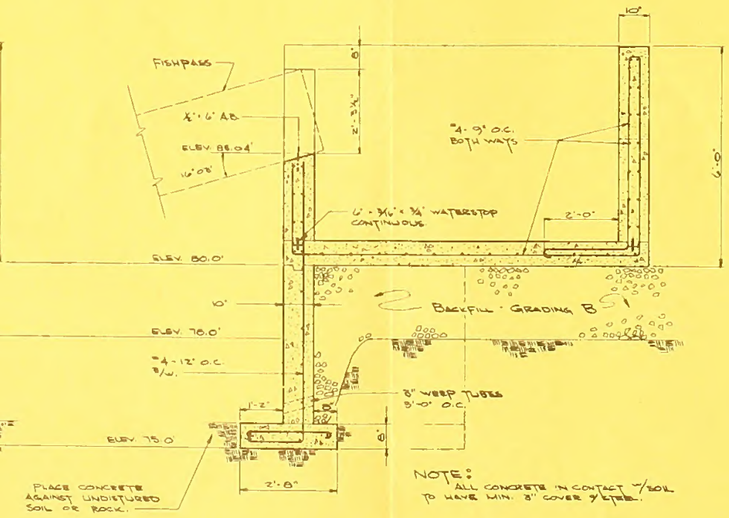


SECTION A-A SCALE: 1"=1'-0"

BASE



SECTION B-B SCALE: ½"=1'-0"



NOTE:
ALL CONCRETE IN CONTACT W/SOIL TO HAVE MIN. 3" COVER W/ETBR.

SECTION C-C SCALE: ½"=1'-0"

ALWAYS THINK SAFETY

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VINCENT CREEK FISHPASS

DESIGNED J.A.	RECOMMENDED William E. Bissett
DRAWN D.W.	RECOMMENDED R.B. Hunter (CHIEF, DIV. OF TECH. SERV.)
CHECKED J.A.	APPROVED Curtis A. Wright
SCALE AS SHOWN	
DATE APRIL, 1973	SHEET 1 OF 2
DRAWING NO. 36-120-6763	

Illustration 5

The mouth of Explorer 155 Creek before construction of fishpass and ladder box

Illustration 6

The mouth of Explorer 155 Creek after installation of ladder box and fishpass

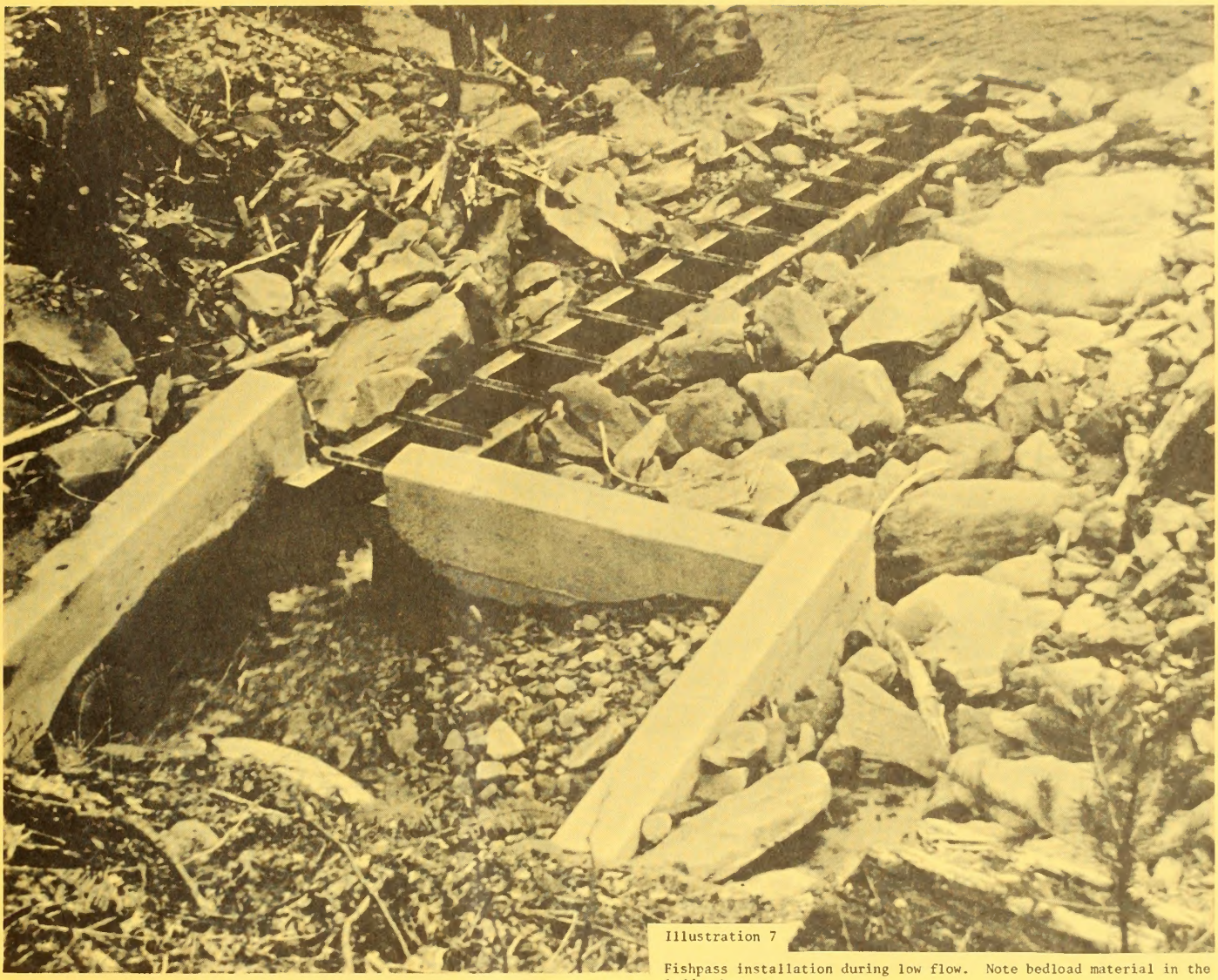


Illustration 7

Fishpass installation during low flow. Note bedload material in the ladder box.

Illustration 8

Fishpass installation during high flow. Note water being forced into the top of the ladder by front overflow wall being too high. Also note water flowing in and out of the ladder as it moves down the ladder, due to improper contouring of riprap.

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